



Technology Readiness Revisited

A proposal for extending the scope of impact assessment of European public services

*G. Lobo – Programme Manager – EU Policies
Interoperability and Digital Government Unit*

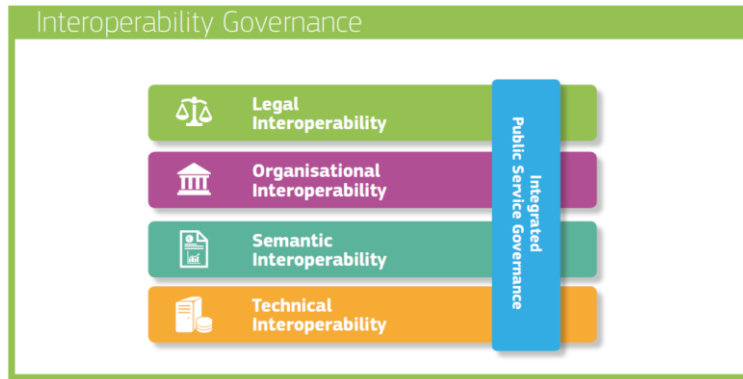
Outline

- Context of the work
- TRL Scale Details
- Issues in TRL
- Societal Readiness Level (SRL)
- Organisational Readiness Level (ORL)
- Legal Readiness Level (LRL)
- Research Framework
- Applications
- Conclusion

Authors and Affiliations

- **Authors and Affiliations**
Ilenia Bruno, Alessandro Donarelli, Valeria Marchetti, Anna Schiavone Panni, Beatrice Valente Covino – KPMG
Georges Lobo - European Commission
Francesco Molinari - Independent

Context: digital public administrations



- Under the EU [ISA² programme](#) (now in [Interoperable Europe](#)): interoperability for digital public services
- Based on the [European Interoperability Framework \(EIF\)](#)

- Potential emerging technologies (AI, blockchain, IoT,...) in the context of Public Administration
- element of the [**A multi-dimensional framework to evaluate the innovation potential of digital public services**](#)
 - Assess potential of digital technologies
 - Promote innovation in European public services
 - Ensure cross-border and cross-domain interoperability
 - Policy Tool Proposal

Contextualising the Proposal

- Context of the Proposal
- Revision and extension of the TRL scale
- Support for EU governments in adopting digitalized public services
- Current Digitalisation Trends
- Fastened over the past decade
- Low adoption of impactful technologies like Blockchain, AI, VR, etc.
- Implications of Low Adoption
- Gaps between expectations and achievements of government transformation
- Poor levels of digital service usage and public engagement
- Study's Proposal
- Define and assess the impact of novel technologies
- Plan and execute focused activities to promote technology take-up



TRL Scale in Horizon 2020

- Technology Readiness Scale
- Arranged in 9 evolutionary stages
- Shows how far a technology is from operational use
- General Annexes to Horizon 2020 Work Programmes
- Definitions are synthetic
- Linear progress is well outlined
- Stages of Technology Development
- Initial stage: Curiosity-driven research
- Final stage: Fully developed and tested innovation
- Launched as a new product/service in the market

TRL Scale Table

MATURITY LEVEL	DESCRIPTION
TRL1	Basic principles observed
TRL2	Technology concept formulated
TRL3	Experimental proof of concept
TRL4	Technology validated in lab
TRL5	Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
TRL6	Technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
TRL7	System prototype demonstration in operational environment
TRL8	System complete and qualified
TRL9	Actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

Usage of TRL Scale

- Comparing Diverse Technologies
- Positioning on the TRL scale
- Blockchain and Distributed Ledger Technologies vs. Digital Signature or e-Identity
- Monitoring Technology Progress
- Tracking progress over time
- Evaluating public grant allocation
- Supporting case study analysis of technology implementation pilots
- Usage in EU and National/Regional Levels
- Wider usage during 2014-2020 programming period
- Requirement in Horizon 2020 funding applications
- Understanding TRL Stages

Issues of TRL in Public Sector

- Non-linear, cyclical, and iterative nature of technology development
- Need to revisit laboratory principles during experimentation
- Different sub-products may hold different TRLs and progress at different speeds
- Defense of TRL Based Approach
- TRL used as a Research and Innovation Policy tool
- Supports decision making for financing R&D investments with public grants
- Clarifies and specifies the differential impact of public grants
- Progress along TRL scale can be seen as linear when temporally defined

Proposed Extensions: SRL, ORL, LRL

- Integration of Societal Aspects in Technology Modelling
- Measured by a 9-stage SRL (Societal Readiness Level) scale
- Focus on readiness to adopt resulting innovation
- Consideration of Organisational Impacts
- Measured by a 9-stage ORL (Organisational Readiness Level) scale
- Includes infrastructure, process, and human skills requirements
- Interaction with Legal and Ethical Systems
- Measured by a 9-stage LRL (Legal Readiness Level) scale
- Considers pressure to modify existing legal and ethical systems
- Relevance in European Public Sector
- Public services need high TRLs for bulletproof technologies
- High SRL ensures actual use by targeted audience



Introduction to SRL

- Definition of SRL
- Proposed by [Innovation Fund Denmark](#)
- Assesses societal acceptance of technology, product, process, or intervention
- Intuition Behind SRL
- Integration of innovation in societal environment
- Higher SRL indicates higher integration
- Lower need for ad-hoc measures for societal adaptation
- Analysis of SRL
- Readiness of society to adopt the solution
- Technology neutral approach
- No overlap with TRL

SRL Scale Table

MATURITY LEVEL	DESCRIPTION
SRL1	Identification of the generic societal need and associated readiness aspects
SRL2	Formulation of proposed solution concept and potential impacts; appraisal of societal readiness issues; identification of relevant stakeholders for the development of the solution
SRL3	Initial sharing of the proposed solution with relevant stakeholders (e.g. through visual mock-ups): a limited group of the society knows the solution or similar initiatives
SRL4	Solution validated through pilot testing in controlled environments to substantiate proposed impacts and societal readiness: a limited group of the society tests the solution or similar initiatives
SRL5	Solution validated through pilot testing in real or realistic environments and by relevant stakeholders: the society knows the solution or similar initiatives but is not aware of their benefits
SRL6	Solution demonstrated in real world environments and in co- operation with relevant stakeholders to gain feedback on potential impacts: the society knows the solution or similar initiatives and awareness of their benefits increases
SRL7	Refinement of the solution and, if needed, retesting in real world environments with relevant stakeholders: the society is completely aware of the solution's benefits, a part of the society starts to adopt similar solutions
SRL8	Targeted solution, as well as a plan for societal adaptation, complete and qualified; society is ready to adopt the solution and have used similar solutions on the market
SRL9	Actual solution proven in relevant societal environments after launch on the market; the society is using the solution available on the market



Introduction to ORL

- ORL is a new approach
- Definition of Impact
- Includes results of innovative efforts and broader effects
- Key areas: roles, competencies, skills, functions, processes, infrastructures
- Public Sector Innovation Policy
- Governance systems as an analytical dimension
- Relates to organisational interoperability in the EIF
- Organisational Readiness
- Capacity of a public body to survive innovation
- Inward looking aspect of ORL

ORL Scale Table

MATURITY LEVEL	DESCRIPTION
ORL1	Identification of the organizational need (infrastructures, capabilities, skills) and associated organisational readiness aspects
ORL2	Formulation of proposed solution concept and potential impacts; appraisal of organisational readiness issues; identification of relevant roles, processes, functions and structures for the solution
ORL3	Comprehensive description of proposed solution's impacts within the organisation in terms of roles, competences and skills, physical infrastructures required
ORL4	Solution validated through simulation of major induced changes to substantiate proposed impacts and organisational readiness: the organisation which is developing the solution starts to acquire roles, competences and skills, physical infrastructures required
ORL5	Proposed solution validated through pilot testing in real or realistic organisational environments: the organisation which is developing the solution achieves roles, competences and skills, physical infrastructures required
ORL6	Solution demonstrated in real world environments and in co- operation with relevant stakeholders to gain feedback in order to improve roles, processes, functions and infrastructures required
ORL7	Refinement of the roles, processes, functions and infrastructures required and retesting of the solution in relevant organisational environments
ORL8	Targeted solution, as well as a plan for organisational embedment, complete and qualified: roles, processes, functions and infrastructures are available
ORL9	Actual solution proven in relevant organisational environments: roles, processes, functions and infrastructures are correctly used for the solution on the market



Introduction to LRL

- LRL is a new approach
- Original approach for research purposes
- Relates to legal interoperability in the EIF
- Less rooted in academic literature or practice
- Analogy with SRL and ORL
- Formulates a maturity model
- Focuses on compliance and transformative power
- Importance of Legal Compliance
- New technologies must adhere to existing rules
- Legal systems evolve with breakthrough innovations
- Example of Artificial Intelligence
- Innovation and Legal Compliance
- Technology Neutral Approach

LRL Scale Table

MATURITY LEVEL	DESCRIPTION
LRL1	Generic consideration of legal and ethical compliance aspects are observed but nothing has yet been done for the development of the solution
LRL2	Formulation of the need to enhance the legal normative, laws, rules and guidelines and solution concept; appraisal of legal and ethical compliance issues
LRL3	Abstract description of the proposed solution's legal and ethical compliance
LRL4	Solution's legal and ethical compliance prospects validated against any required or recommended changes in the legal and/or regulatory system
LRL5	Definition of the proposed solution's legal and ethical compliance status after pilot testing in real or realistic organisational environments
LRL6	Detailed description of the required or recommended changes in relevant laws, regulations or organisational rules to ensure full compliance with the proposed solution
LRL7	Refinement of the solution within the existing legal and ethical system and, if needed, proposals for required or recommended changes to some aspects of it
LRL8	Targeted solution, as well as a legal and ethical compliance audit, complete, qualified and ready to be launched on the market
LRL9	Actual solution proven legally and ethically compliant after launch on the market

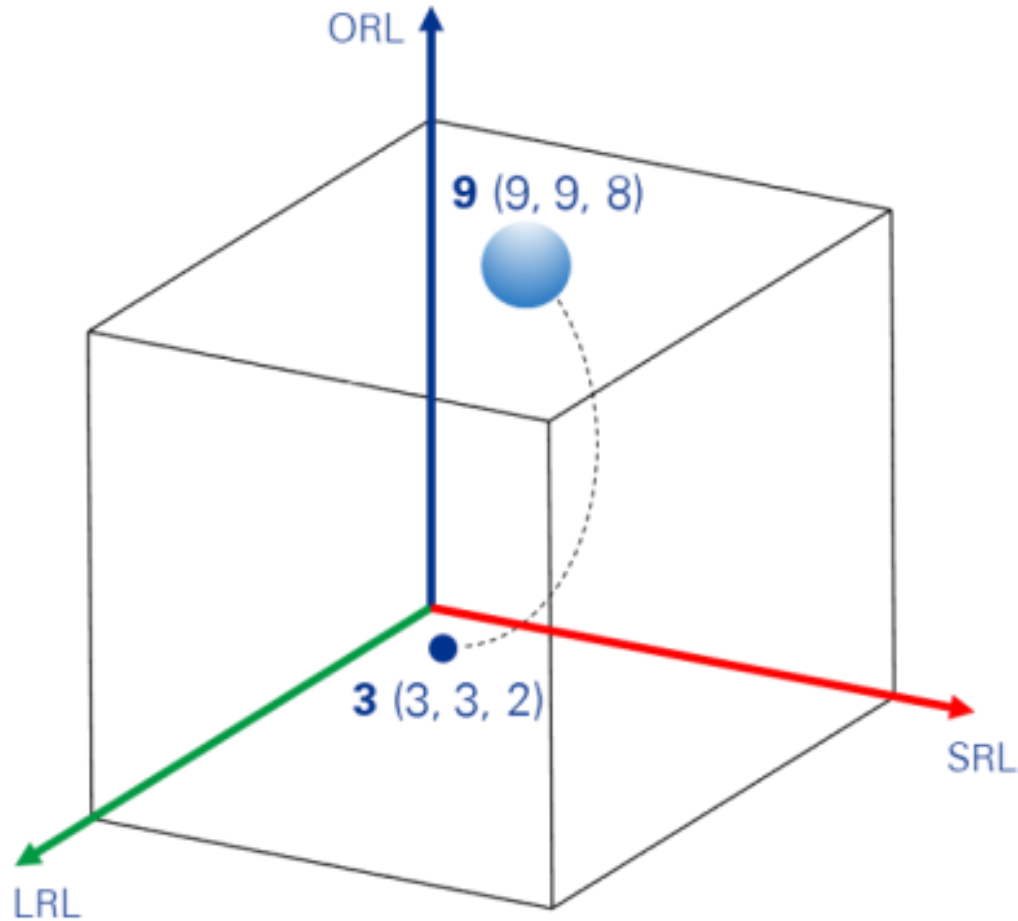
Impact Assessment Approach

- Concrete Implementations of Technologies
- Focus on real or realistic implementations
- Often in a public sector environment
- Analytical Goals
- Retrieve each technology within a specific pilot
- Pilots are small-scale, short-time experiments
- Reusable Framework
- 4-Axis Framework

Overview of the 4-Axis Framework

- Unifying Framework for Assessing Digital Technologies
- Combines four Readiness Level scales
- Promotes innovation in European public services
- Aims for sustainable technology adoption
- Maturity Models and Technology Readiness
- Help organizations learn implications of adoption
- Technology Readiness
- Includes societal, organizational, and legal aspects
- Transitioning Pathways
- Correlation Between Readiness Levels
- Match between TRLs, SRLs, ORLs, and LRLs
- Artificial but logical construction
- Understanding enablers and barriers in social, organisational, and legal contexts

Applications



- Scenario Description
- TRL of a given technology is known and fixed in advance
- Represented as a point in 3D space with coordinates (l, s, o)
- Non-Technological Dimensions
- Legal Readiness (l)
- Societal Readiness (s)
- Organisational Readiness (o)
- Adding TRL as Fourth Variable
- Conceptualized as a 4D cube with coordinates (t, l, s, o)
- Measured by the size of a small ball inside the cube
- Example of Technology Pilot
- Run between t0 and t1 in a certain location

Case Study 1: Open Data Initiative

Implementation and Goals

Open data initiative for public utilities and related domains

Aimed to enable cross-sectoral collaborations and promote data-driven businesses

Technology and Innovation

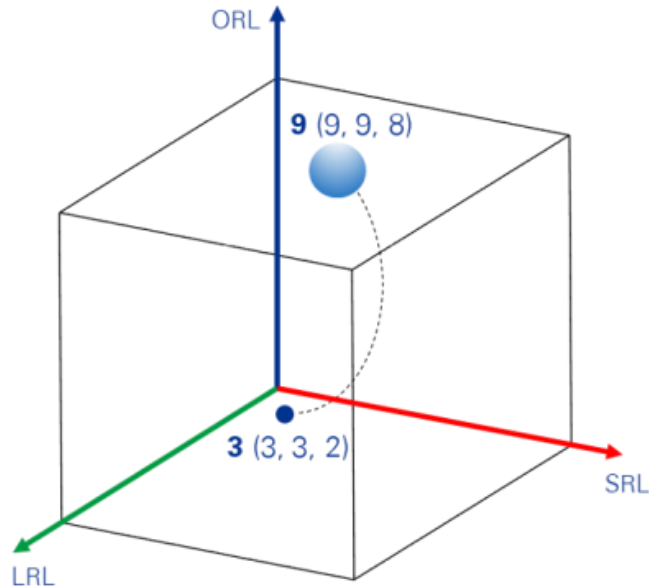
Open data platform with innovation network and mobile app

Enabled data visualizations, downloads, and ad hoc data requests

Readiness Levels

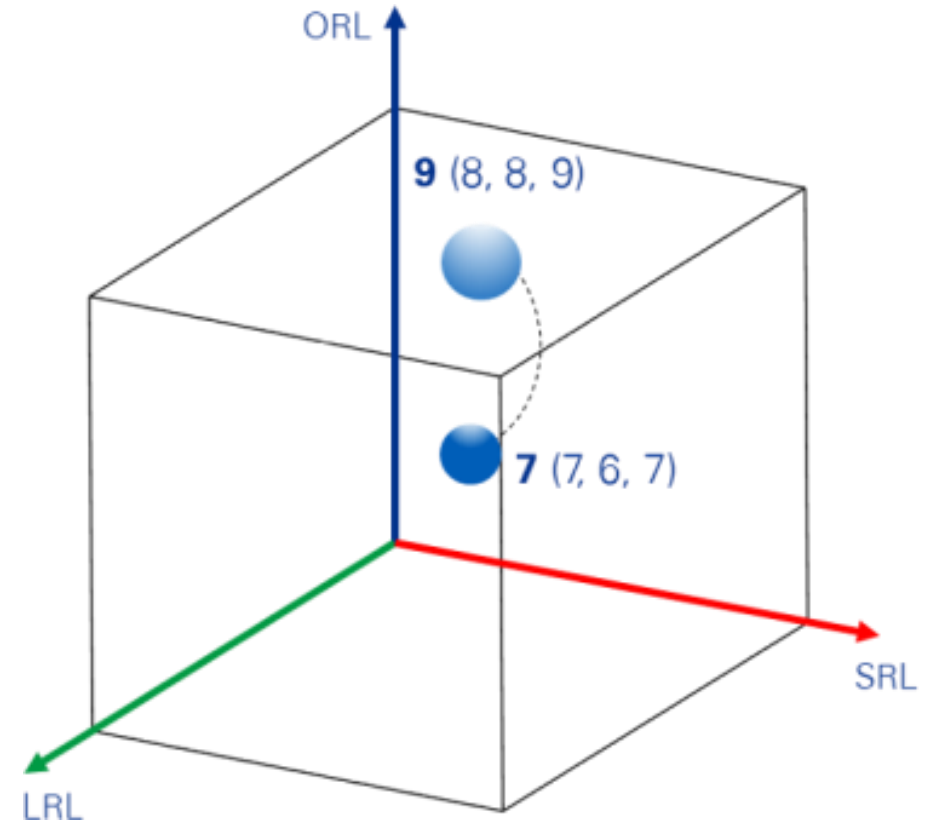
Technology Readiness Level increased from 3 to 9 in six years

Societal and Organisational Readiness Levels also showed significant growth



Case Study 2: Blockchain Technology

- Implementation of Blockchain Technology
- Automated and tamper-proof online identity verification
- Use of multifactor biometric authentication
- Focus on Readiness Levels
- TRL moved from level 8 to 9
- SRL and ORL required small adjustments
- LRL passed from level 8 to 9
- High Interoperability
- Technological and legal replication
- Issues with semantic and organisational interoperability
- User Centricity Principles
- EU Horizon 2020 Work Programmes



Conclusion

- Respectful of Innovation Variety
- Considers diverse innovation modes in the EU socioeconomic scenario
- Addresses both disruptive and consolidated technologies
- Attentive to Contextual Aspects
- Considers legal, organisational, societal, and cultural factors
- Supports innovative procurement and scaling up technologies
- Compatible with Various Domains
- Adapts to technological and non-technological domains

Thank you!



interoperable europe

innovation ∞ govtech ∞ community

Stay in touch



[\(@InteroperableEU\) /](#)



[Twitter
Interoperable Europe -](#)



[YouTube
Interoperable Europe |](#)



[LinkedIn
DIGIT-INTEROPERABILITY@ec.europa.eu](#)



<https://joinup.ec.europa.eu/collection/interoperable-europe/interoperable-europe>